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Lake and River Enhancement Section
Division of Fish and Wildlife/IDNR
402 W. Washington Street, W-273
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RAPID BIOASSESSMENT OF THE
UPPER LAUGHERY CREEK WATERSHED
USING BENTHIC MACROINVERTEBRATES

for the Soil and Water Conservation Districts of
Franklin, Decatur and Ripley Counties

Study Conducted During
July and October 1994

Study Conducted By:

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EXECUTIVE SUMMARY

A rapid bioassessment technique was used to determine the degree of biological impairment present in several tributaries of the upper Laughery Creek watershed in southeastern Indiana prior to full implementation of various land treatments in the watershed. The benthic communities of four sites and a nearby reference stream were sampled during July and/or October 1994 to provide information on "before treatment" conditions.

The benthic community at each site was usually dominated by caddisflies or mayflies, which are generally intolerant to environmental degradation. However, most study sites were also characterized by higher proportions of "tolerant" midge larvae and fewer kinds of "intolerant" animals than the regional reference stream. The three study sites sampled during July (Little Laughery Creek, Walnut Creek, and an unnamed tributary) were slightly impacted by habitat and/or water quality degradation. A fourth site on Laughery Creek, sampled only in October, was also slightly impacted.

The benthic community of a site on Little Laughery Creek near Batesville showed significant improvement between sampling periods. The biological score at this site indicated change from "slight impairment" in July to "no impairment" during October. Improved water quality in the form of reduced sedimentation was probably responsible for this change. This improvement is an indication that land treatments in the watershed may already be having a beneficial effect on water quality.

INTRODUCTION

This study was conducted to measure the "biological integrity" of the headwaters of Laughery Creek in southeastern Indiana. Laughery Creek has been identified by the Soil and Water Conservation Districts of Franklin, Decatur, and Ripley Counties and by the Indiana Department of Environmental Management (IDEM) as having seriously degraded water quality due to nonpoint sources of pollution [1]. Soil conservation plans have been designed by the local SWCD offices to help reduce non-point source problems in the stream. By conducting studies of the biological community of Laughery Creek before and after application of land treatments in the watersheds, the study can help determine whether treatments resulted in improved water quality as reflected by an improved aquatic biological community.

Land treatments in the watershed were initiated in October 1993. The first study was conducted in July 1994 and repeated in October 1994.

Local Setting

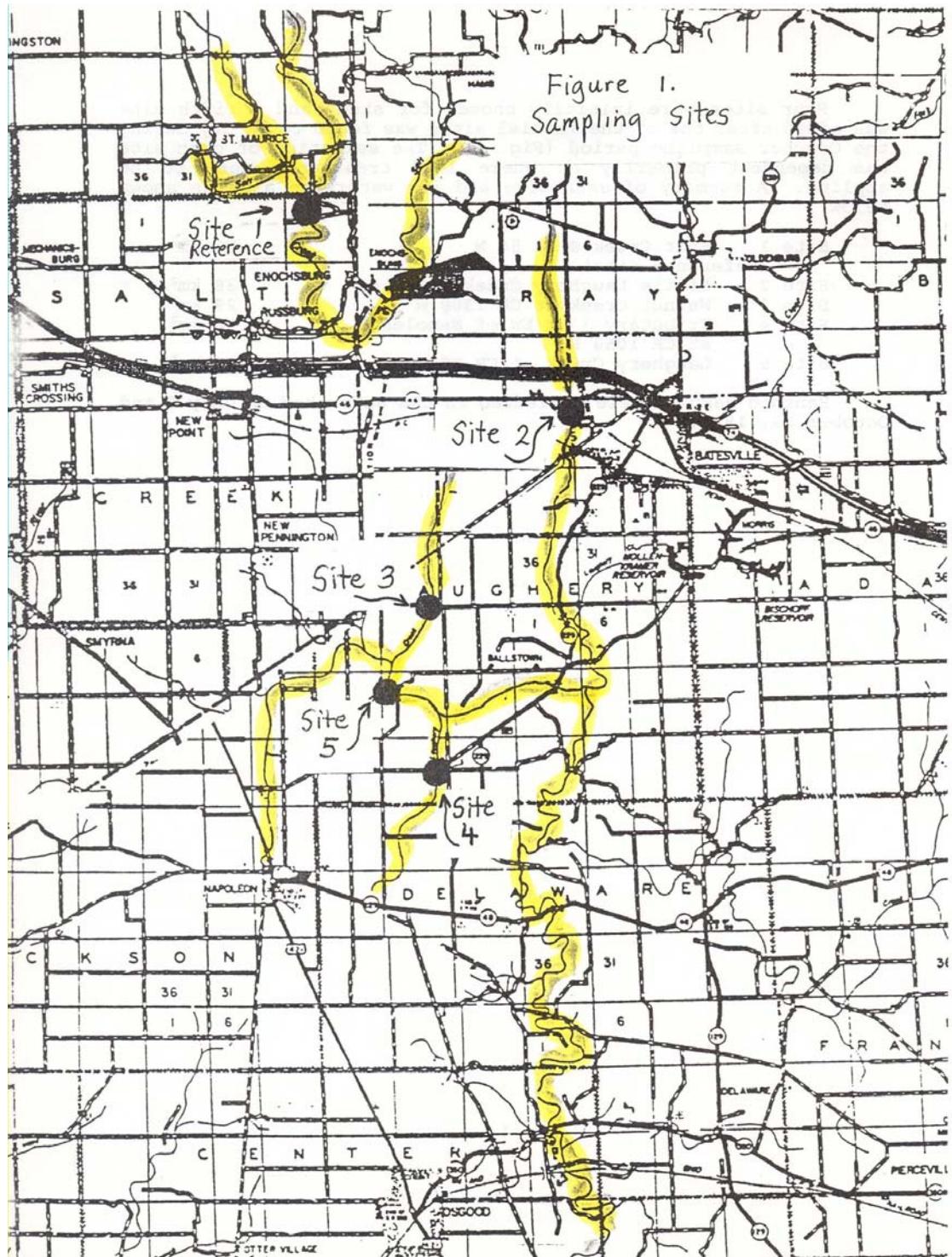
The upper portions of Laughery Creek are located near the border between the "Eastern Corn Belt Plains" and "Interior Plateau" ecoregions of the Central U.S. [2]. The entire watershed lies in what is sometimes called the "Bluegrass (Switzerland Hills)" Natural Region of Indiana [13]. This ecoregion is composed of a glacial till plain with rolling to deeply dissected plateaus. Limestone outcrops are common and soils are derived from sedimentary rocks and loess. Agriculture and livestock grazing are the most common land uses.

The Laughery Creek tributaries included in this study are all small "second or third order" streams with total watershed areas of about 15-80 square kilometers. Much of upper Laughery Creek is channelized but some of the tributaries retain their natural channel characteristics. Only about 25% of the watershed is wooded.

Four sites were initially chosen for study and a fifth site was added after one of the initial sites was found to be dry during the October sampling period (Fig. 1). The selection of each site was dependent primarily on where land treatments were to be applied. A summary of each site and its watershed area is shown below:

Site 1	Salt Creek @ CR 50 N (Reference Site)	72 km ²
Site 2	Little Laughery Creek @ Hwy 46	38 km ²
Site 3	Walnut Creek at CR 1300 N	29 km ²
Site 4	Tributary 3 km NW of Napolean at CR 1050 N	16 km ²
Site 5	Laughery Creek at CR 200 W	80 km ²

Benthic samples were collected in the watershed on July 8 and October 29, 1994.



METHODS

Because they are considered to be more sensitive to local conditions and respond relatively rapidly to environmental change [3], benthic (bottom-dwelling) organisms were used to document the biological condition of upper Laughery Creek. The U.S. Environmental Protection Agency (EPA) has recently developed a "rapid bioassessment" protocol [4] which has been shown to produce highly reproducible results that accurately reflect changes in water quality. We used EPA's Protocol III to conduct this study. Protocol III requires a standardized collection technique, a standardized subsampling technique, and identification of at least 100 animals from each site to the genus or species level from both "study sites" and a "reference site."

Reference Site

The aquatic community of a reference site is compared to that of each study site to determine how much impact has occurred. The reference site should be in the same "ecoregion" as the study sites and be approximately the same size. It should be as pristine as possible, representing the best conditions possible for that area. Salt Creek in Decatur and Franklin Counties was chosen as the reference site for this study. Its watershed area is about 72 square kilometers, which is similar to that of most study sites on Laughery Creek, and it is located only a few kilometers north of the upper Laughery Creek watershed. Salt Creek is known to support an extremely diverse fishery, including many "intolerant" species [5]. Therefore, its habitat and water quality are probably among the best available within this area. Agriculture is an important land use in the Salt Creek watershed, but the upper portions of this stream retain a more natural riparian corridor than most Laughery Creek tributaries.

Sample Collection

Samples in this study were collected by kicknet from riffle habitat where current speed was 20-30 cm/sec. Riffles were used because they were the most important benthic habitat present at all study sites. The kicknet was placed immediately downstream from the riffle while the sampler used a hand to dislodge all attached benthic organisms from rocks upstream from the net. The organisms were swept by the current into the kicknet and subsequently transferred to a white pan. Each sample was examined in the field to assure that at least 100 organisms were collected at each site. In addition, each site was sampled for organisms in CPOM (coarse particulate organic matter, usually consisting of leaf packs from fast-current areas). All samples were preserved in the field with 70% isopropanol.

Laboratory Analysis

In the laboratory, a 100 organism subsample was prepared from each site by evenly distributing the whole sample in a white, gridded pan. Grids were randomly selected and all organisms within grids were removed until 100 organisms had been selected from the entire sample.

Each animal was identified to the lowest practical taxon (usually genus or species). As each new taxon was identified, a representative specimen was preserved as a "voucher." All voucher specimens will ultimately be deposited in the Purdue University Department of Entomology collection.

Quality Assurance

To help assure the quality of the results, a duplicate sample was collected at site 1 during October. The biological scores of each sample were measured to determine the amount of variability associated with the technique. Ideally, the individual scores of duplicate samples should be within about 10% of the mean score to assure that reproducible results are obtained.

RESULTS

Quality Assurance

The biotic index scores of site 1, as determined by duplicate samples, were within 10% of the mean and the use impairment categories obtained by both samples were identical. This indicates that the bioassessment technique is producing reliable results during this study period.

Aquatic Habitat Analysis

When the EPA habitat scoring technique was used, the following aquatic habitat values were obtained for each site in the study:

	Score	% of Reference
Salt Creek (reference , Site 1)	108	100
Little Laughery Creek (Site 2)	93	86
Walnut Creek (Site 3)	72	67
Unnamed tributary (Site 4)	85	79
Laughery Creek (Site 5)	102	95

The maximum value obtainable by this scoring technique is 135, with higher values indicating better habitat. Sites with lower habitat values normally have lower biotic index values as well.

The scores indicate that the lowest habitat value in this study was at Site 3 (Walnut Creek near CR 1300 N). Habitat at this site was hampered most by a paucity of stable bottom substrate. In addition, this site became almost completely dry during the late summer and the benthic community could not be sampled during October. All study sites also suffered from various degrees of channel alteration, lack of shading, and sediment deposition.

Water Quality Measurements
July 8, 1994

	D.O. mg/l	pH SU	Cond. uS	Temp. (C)
Reference Site 1 Time = 2:30 p.m.	9.7	8.1	320	25
Site 2 Time = 1:30 p.m.	11.6	8.4	350	27
Site 3 Time = 12:10 p.m.	14.6	8.5	390	27
Site 4 Time = 10:50 a.m.	9.2	8.3	350	25

Water Quality Measurements
October 29, 1994

	D.O. mg/l	pH SU	Cond. uS	Temp. (C)
Reference Site 1 Time = 1:00 p.m.	10.2	7.9	360	14
Site 2 Time = 2:00 p.m.	9.9	8.4	400	15
Site 3 Time = 3:00 p.m.	9.6	8.1	310	11
Site 4 Time = 5:00 p.m.	9.6	8.1	320	14
Site 5 Time = 4:00 p.m.	9.4	7.6	320	12

D.O. = Dissolved Oxygen
Cond. = Conductivity
Temp. = Temperature in Degrees Centigrade

Table 1.
Rapid Bioassessment Results - Laughery Creek - July 1994

	Site #			
	1	2	3	4
Chironomidae	—	—	—	—
<i>Cardiocladius</i> sp.		1		
<i>Cricotopus bicinctus</i>	1	1		
<i>Cryptochironomus fulvus</i>			2	
<i>Polypedilum convictum</i>	2	13		4
<i>P. illinoense</i>	1	2	28	
<i>P. fallax</i>	1	3		1
<i>Microtendipes caelum</i>		3		11
unidentified Chironomini				1
<i>Harnischia</i> sp.	1		6	2
<i>Thienemannymia</i> gr.	2	8	36	1
Simuliidae		1	7	
Ephemeroptera				
<i>B. brunneicolor</i>	13	6	11	10
<i>Caenis</i> sp.			2	
Trichoptera				
<i>Cheumatopsyche</i> spp.	42	28	12	24
<i>Hydropsyche betteni</i>	3	4		11
<i>Ceratopsyche sparna</i>	4	2		10
<i>C. bifida</i>	2			
Coleoptera				
<i>Macronychus glabratus</i>	25	4	2	4
<i>Stenelmis</i> sp.				15
<i>Dubiraphia</i> sp.		1		1
<i>Psephenus herricki</i>	1			
<i>Berosus</i> sp.			1	1
Amphipoda				
<i>Hyalella azteca</i>			1	1
Isopoda				
<i>Caecidotea</i> sp.			1	
Gastropoda				
<i>Physella</i> sp.		7		1
Pelecypoda				
<i>Sphaerium</i> sp.		6		
Oligochaeta				
<i>Tubificidae</i>		3		
Hirudinea			1	
Turbellaria	1			
Total	100	100	100	100

Table 2. Data Analysis for July Samples
METRICS

	Site #			
	1	2	3	4
# of Genera	13	16	10	16
Biotic Index	5.5	6.4	6.1	5.3
Scrapers/Filterers	0.01	0.2	0.0	0.01
EPT/Chironomids	8.0	1.3	0.4	2.5
% Dominant Taxon	42	28	36	24
EPT Index	5	4	3	4
Community Loss Index	0.0	0.2	0.6	0.3
% Shredders (CPOM)	3	0	0	0

SCORING

	Site #			
	1	2	3	4
# of Genera	6	6	6	6
Biotic Index	6	6	6	6
Scrapers/Filterers	6	6	4	6
EPT/Chironomids	6	0	0	2
% Dominant Taxon	0	4	2	4
EPT Index	6	4	2	4
Community Loss Index	6	6	4	6
% Shredders (CPOM)	6	0	0	0
TOTAL	42	32	24	34
% of Reference	100	76	57	81
Impairment Category	N	S	S	S

N = NONE

S = SLIGHT

M = MODERATE

Table 3.
Rapid Bioassessment Results - Laughery Creek - October 1994

	Site #			
	1	2	4	5
Chironomidae				
<i>Cricotopus bicinctus</i>	7	7		
<i>C. trifascia</i>		1		
<i>Orthocladius obumbratus</i>	3		1	
<i>Parametriocnemus lundbecki</i>		1		
<i>Dicrotendipes nervosus</i>		1		
<i>Polypedilum convictum</i>		13		
<i>Thienemannymia gr.</i>	12	8	5	5
Tipulidae				
<i>Tipula sp.</i>	1	3		
<i>Antocha sp.</i>		3		
Simuliidae			26	
Ephemeroptera				
<i>Stenacron interpunctatum</i>			18	
<i>Stenonema vicarium</i>	1			
<i>Stenonema tripunctatum</i>		2		2
<i>Baetis propinquus</i>	1	1		
<i>Isonychia sp.</i>	1			
Trichoptera				
<i>Helicopsyche borealis</i>			57	
<i>Cheumatopsyche</i>	41	20	13	5
<i>Hydropsyche betteni</i>	9	1	1	
<i>Ceratopsyche bifida</i>		4		
<i>Chimarra obscura</i>	1			
Plecoptera				
Capniidae	1	1	3	
Coleoptera				
<i>Stenelmis sp.</i>	5	4	2	1
<i>Psephenus herricki</i>	1			1
Odonata				
<i>Argia sp.</i>				1
Amphipoda				
<i>Hyalella azteca</i>		1	3	
Isopoda				
<i>Lirceus sp.</i>		1		

Table 3 (continued).
 Rapid Bioassessment Results - Laughery Creek - October 1994

	Site #			
	1	2	3	4
Gastropoda				
<i>Elimia livescens</i>		2	48	
<i>Physella sp.</i>		5		
<i>Ferrissia rivularius</i>	2			
Pelecypoda				
<i>Sphaerium striatinum</i>			2	
<i>Sphaerium simile</i>			4	
Annelida				
<i>Hirudinea</i>	10	1	4	
Turbellaria			9	13
Total	100	100	100	100

Table 4. Data Analysis for October Samples

	METRICS			
	Site #			
	1	2	4	5
# of Genera	16	19	11	10
Biotic Index	6.5	6.3	4.8	7.3
Scrapers/Filterers	0.1	0.2	4.3	6.3
EPT/Chironomids	2.7	0.8	12	5.0
% Dominant Taxon	41	26	57	48
EPT Index	7	6	4	3
Community Loss Index	0.0	0.4	0.6	1.1
% Shredders (CPOM)	2	18	3	1
 SCORING				
	Site #			
	1	2	4	5
# of Genera	6	6	4	4
Biotic Index	6	6	6	4
Scrapers/Filterers	6	6	6	6
EPT/Chironomids	6	0	6	6
% Dominant Taxon	0	4	0	0
EPT Index	6	6	2	2
Community Loss Index	6	6	4	4
% Shredders (CPOM)	6	6	6	6
TOTAL	42	40	34	32
% of Reference	100	95	81	76
Impairment Category	N	N	S	S

N = NONE

S = SLIGHT

M = MODERATE

DISCUSSION

Chemical parameters measured at each site indicate that dissolved oxygen and pH fell within acceptable ranges for most forms of aquatic life. Sites 2 and 3 (Little Laughery Creek and Walnut Creek at CR 1300 N) had dissolved oxygen levels well above saturation during July, indicating that algal growth was probably very high upstream from these locations.

A total of 41 macroinvertebrate genera were collected at the four sites during each of the two sampling periods. The most commonly collected invertebrates at most sites were caddisfly larvae (Cheumatopsyche sp. or Helicopsyche borealis), midge larvae (e.g. Polypedilum or Thienemannimyia) or snails (Elimia livescens).

Figure 2 shows the normal relationship of biotic index scores to habitat values (a linear relationship according to [4]). The figure also shows a range of plus or minus 10% to account for a certain amount of measurement variability. When biotic index values fall outside this range, the site typically has degraded water quality. Figure 2 indicates that during July sites 2 and 3 had biotic values significantly lower than expected from their measured habitat values. This was also true at Site 5 during October. Therefore, these sites were probably affected by both degraded habitat and degraded water quality. The graph suggests that Site 4 probably supports an aquatic community as good as its present habitat allows.

An examination of those metrics showing the greatest difference from the reference stream may provide an important clue about causes of biological impairment at sites 2 and 3. The largest differences at these sites occurred in the EPT/Chironomid ratio and the % shredders metrics. The decline of EPT organisms and a concurrent rise in chironomid abundance is associated with several kinds of environmental degradation. For example, several studies have shown this metric to be associated with instream toxicity [6]. However, changes in other metrics commonly indicating toxicity problems (e.g. a reduction in the number of taxa) were not observed and few "toxic indicator" organisms were observed at any site. A more likely explanation for this shift in the types of animals present is stress caused by stream sedimentation or nutrient enrichment, often associated with agricultural runoff. Such changes favoring chironomids at the expense of EPT taxa have been observed in other studies [8].

Figure 2
Biotic Index vs. Habitat Score

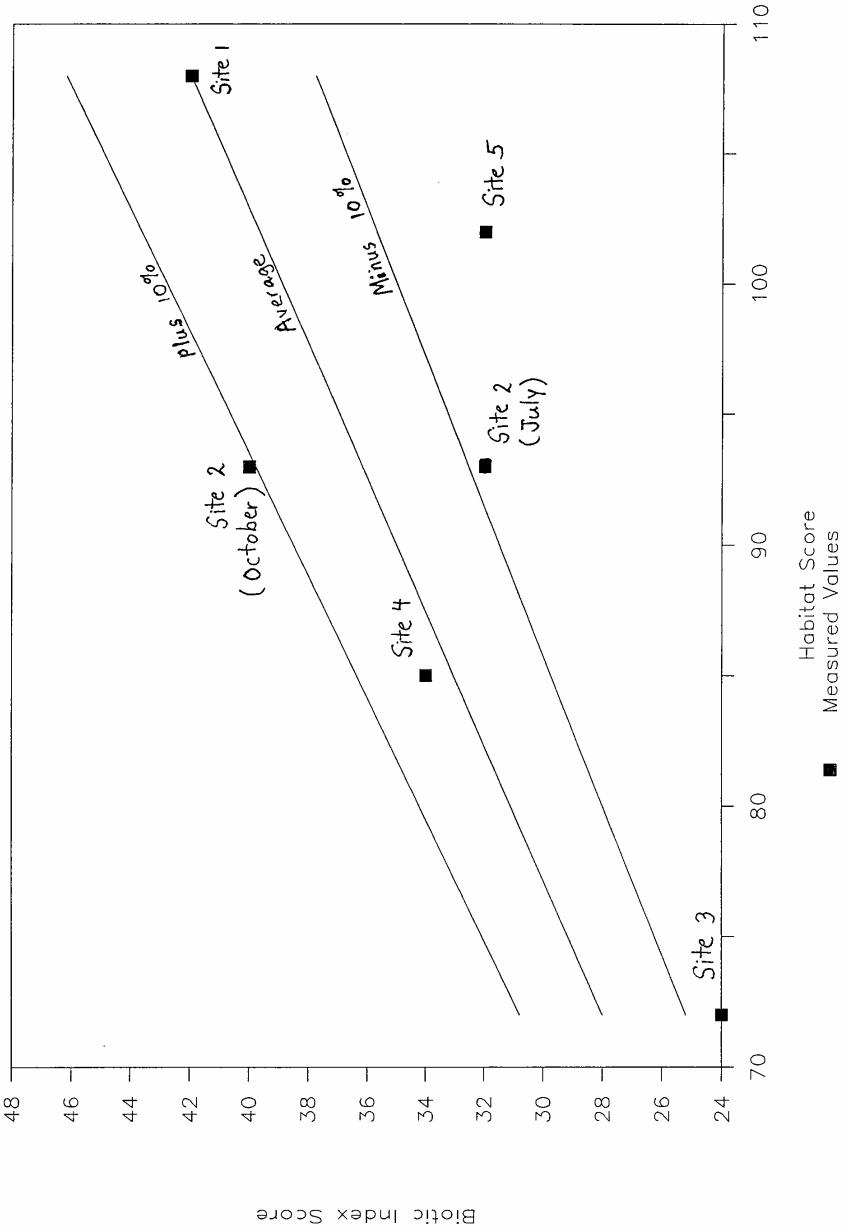


Table 5 shows sediment-tolerance values for many of the commonly collected animals in these streams. Sediment and turbidity-tolerant forms were abundant at all sites, including the reference site. The habitat evaluation study found that Sites 2 and 3 had a higher degree of fine-sediment "embeddedness" than the reference site and the proportion of sediment-tolerant animals present at these sites was slightly higher as well, at least during the July sampling period. The proportion of sediment-tolerant species at Site 2 declined somewhat between July and October, perhaps helping to explain why the biotic index value of this site increased significantly.

Chemical sampling revealed that sites 2 and 3 were also affected by noticeably higher dissolved oxygen (D.O.) levels than the other sites. While this is not necessarily harmful to aquatic life, it is indicative of more intense algal growth often associated with high nutrient inputs and lack of shading. Often, waterbodies in which algal growth is abundant may have high D.O. levels during midday but relatively low levels at night, when algae stop photosynthesizing and begin to respire. Lower D.O. levels can eliminate some types of sensitive macroinvertebrates. It is interesting to note that the Hilsenhoff Biotic Index (HBI) metric, which is highly sensitive to D.O. changes, was also higher at sites 2 and 3 than at the other two sites during July. These results indicate that, in addition to sedimentation, nutrient loading and lack of shading may also be contributing to the water quality degradation apparently observed at sites 2 and 3 during the July sampling period.

Site 5 on Laughery Creek, sampled only during October, had habitat similar to the reference site but a significantly lower biotic index score. This site had an elevated HBI metric, indicating lower than normal dissolved oxygen levels may occur there on occasion. Because few sediment-tolerant animals were present, excess sediment did not seem to be causing the problem. Instead, its lower water quality may be more closely related to upstream "point" sources of pollution (e.g. the Town of Napolean's sewage treatment plant or other BOD-generating discharges).

Comparison to Other Studies

There are no previously published studies of the benthic macroinvertebrate communities of these streams. Fifty years ago, Gerking [12] collected only 6 fish species from upper Laughery Creek near Osgood (15-20 species is more typical of unimpacted sites). None of the fish collected were "intolerant" species. Although the historical record does not give a clear reason for this lack of biological diversity, it appears that upper Laughery Creek has been biologically degraded for a number of years.

Table 5. Sediment-Tolerant Species Observed
(References shown in brackets)

Cheumatopsyche sp.	[8]	[9]
Hydropsyche betteni	[8]	
Caenis sp.	[9]	[11]
Polypedilum convictum	[9]	
Thienemannymia group	[9]	
Tubificidae	[11]	

July Samples

% of Sediment-Tolerant Organisms at the Reference Site	45%
% of Sediment-Tolerant Organisms at the Study Sites	
Site 2	56%
Site 3	72%
Site 4	38%

October Samples

% of Sediment-Tolerant Organisms at the Reference Site	62%
% of Sediment-Tolerant Organisms at the Study Sites	
Site 2	42%
Site 4	19%
Site 5	10%

Table 5. (cont.)
Sediment-Intolerant Species Observed

Plecoptera	[9]
Microtendipes sp.	[9]
Harnischia sp.	[6]
Hyalella azteca	[10]
Tipula sp.	[9]
Antocha sp.	[9]
Ceratopsyche sp.	[7]
Helicopsyche borealis	[15]
Stenonema vicarum	[14]
S. tripunctatum	[14]

July Samples

% of Sediment-Intolerant Organisms at the Reference Site	7%
% of Sediment-Intolerant Organisms at the Study Sites	
Site 2	5%
Site 3	6%
Site 4	23%

October Samples

% of Sediment-Intolerant Organisms at the Reference Site	6%
% of Sediment-Intolerant Organisms at the Study Sites	
Site 2	10%
Site 4	63%
Site 5	2%

RECOMMENDATIONS

1. Continue to monitor these sites during 1995 to help determine whether land treatments initiated in 1993 contribute to improved water quality in the watershed.
2. Site 3 on Walnut Creek dries up during dry, low-flow conditions. Because the rapid bioassessment technique can be used successfully only in flowing streams, monitor this site only in spring or early summer.
3. Despite its very small watershed area, the unnamed tributary at site 4 has more-or-less permanent flow and appears to be spring-fed, with high water quality. Since Laughery Creek has few such tributaries, this stream is worthy of continued protection and enhancement.
4. Site 5 had somewhat lower water quality than the other sites, possibly due to upstream "point" sources rather than agricultural runoff. Land treatments in the watershed may not improve biotic conditions there over the short-term. Investigations to determine the source of degraded water quality in this watershed should be conducted by the Indiana Department of Environmental Management.
5. Consider adding an additional monitoring site on Ripley Creek to determine whether this major Laughery Creek tributary is contributing to water quality problems in the watershed.
6. Only one sampling period per year appears to be necessary to provide useful biotic index values in this watershed.

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Site 1

PHYSICAL CHARACTERIZATION/WATER QUALITY
FIELD DATA SHEETSalt Creek Cr 50 N
(Decatur Co.)

PHYSICAL CHARACTERIZATION

EUPHARUS RIVER/STREAM FEATURES

Predominant Surrounding Land Use: Moderately forest land
 recent field/feature: Agricultural
 Local Watershed Erosion: None
Heavy
 Local Watershed Ags Pollution: No evidence
Cause Potential Sources
 Estimated Stream Width: 6 ft
 Estimated Stream Depth: 1 ft
 High Water Mark: Velocity 20
 Velocity: 20
 Does Present: Yes
No
Shaded
 canopy cover: Open
Partly Open
Partly Shaded

SEDIMENT/SUBSTRATE:

Sediment Odor: Normal
 Sediment Oils: Absent
 slight Moderate Profuse

Sediment Deposites: Sludge
 Sludge

Are the undersides of stones which are not deeply embedded black? No

Inorganic Substrate Components

Substrate Type	Diameter	Percent composition in sampling area	Percent composition in sampling area	Percent composition in sampling area
bedrock				
bedrock	1.154-1.166 mm (1/2-1/8 in.)	20		
cobble	6.1-15.2 mm (1/2-10 in.)			
gravel	2.4-6.4 mm (1/8-1/2 in.)	48		
sand	0.4-2.4 mm (1/16-1/4 in.)			
silt	<0.4-1.154 mm (1/16-1/8 in.)	5		
clay	<1.154 mm (1/16 in.)			

WATER QUALITY

Instrument(s) Used	Temperature	pH	Conductivity	Other
Instrument(s) Used				
Stream Type: Collected	<u>Surface</u>			
Water Odor: Normal	<u>Normal</u>			
Water Surface Oil:	<u>Slush</u>	<u>Oil</u>	<u>Oil</u>	<u>Water color</u>
Turbidity: Clear	<u>slightly turbid</u>	<u>turbid</u>	<u>opaque</u>	<u>Cloudy</u>

WEATHER CONDITIONS

PHOTOGRAPH NUMBER

OBSERVATIONS AND/OR SECTION: DS from this site, there appears to be heavy livestock use in numerous

Site 1

HABITAT ASSESSMENT FIELD DATA SHEET		Saff Creek - CR 50 N		
Habitat Parameter		Category	Good	Fair
1. *Bottom substrate (% available cover)	Greater than 50% rubble, gravel, submerged logs, or other stable habitat undercut banks, or other stable habitat.	10-10% rubble, gravel or other stable habitat. Adequate habitat.	Less than 10% rubble or other stable habitat. Gravel or other stable habitat available.	Lack of habitat is obvious. Less than desirable.
	(V-2)	11-15	6-10	0-5
2. Embeddedness (b)	Gravel, cobble, and boulder particles are between 0 and 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are between 50 and 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are over 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are over 75% surrounded by fine sediment.
	(16-20)	11-15	6-10	0-5
3. 50-15 cms (5cts) * *flow at rep. low flow	Cold >0.5 cms (2 cts) Warm >0.15 cms (5 cts)	0.01-0.05 cms (1-2 cts) 0.05-0.15 cms (2-5 cts)	0.01-0.01 cms (1.5-1 cts) 0.03-0.05 cms (1-2 cts)	0.01 cms (1.5 cts) 0.03 cms (1-2 cts)
	10-20	11-15	6-10	0-5
4. 0.15 cms (5cts) + Velocity/depth	Slow (<0.3 m/s), deep >0.5 m; slow, shallow <0.5 m; fast, >0.3 m/s; deep; fast; shallow habitats all present.	Only 3 of the 4 habitat categories present (missing riffles/runs receive lower score than missing pools).	Only 2 of the 4 habitat categories present (missing riffles/runs receive lower score).	Moderate deposition of heavy deposits of fine new gravel, coarse sand material, increased bar development; most pools partially filled with; and/or extensive channelization.
	(16-20)	11-15	6-10	0-5
4. Channel alteration (a)	little or no enlargement of islands or point bars; and/or no channelization.	Some new increase in bar formation, mostly from coarse gravel; and/or some channelization present.	Some new increase in bar formation, mostly from coarse gravel; and/or some channelization present.	Moderate deposition of heavy deposits of fine new gravel, coarse sand material, increased bar development; most pools partially filled with; and/or extensive channelization.
	(11-5)	6-11	4-7	0-1
5. Bottom scouring and deposition	less than 5% of the bottom affected by scouring and deposition.	5-10% affected, scour at constrictions and where grade is steep. Some deposition in pools.	More than 50% of the bottom affected, scour at constrictions, and pools almost absent. Some filling of pools.	More than 50% of the bottom affected, scour at constrictions, and pools almost absent. Due to deposition, only large rocks in little exposed.
	(12-15)	6-11	4-7	0-1

(a) From Ball 1982.

(b) From Platts et al. 1981.

Note: * = Habitat parameters not currently incorporated into BIOS.

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Figure 5.2.1. Habitat Assessment Field Data Sheet for use with all Rapid Bioassessments Protocols.

Site 1

Salt Creek

HABITAT ASSESSMENT FIELD DATA SHEET (Cont.)

Habitat Parameter	Excellent	Good	Category	Fair	Poor
6. Pool/run/bend ratio [(distance between riffles divided by stream width)]	5-1. Variety of habitat. Deep riffles and pools. Riffles provide habitat.	7-15. Moderate depth in pools and riffles. Riffles provide some habitat.	15-25. Occasional riffles or bend. Bottom contours provide some habitat.	15-25. Essentially straight stream. Generally all riffles water or shallow riffles. Poor habitat.	15-25. Unstable. Many eroded areas. Side slopes up to 60° common. "Tarn" areas frequent along straight sections and bends.
7. Bank stability (a)	Stable. No evidence of erosion or bank failure. Side slopes generally 30%. Little potential for future problem.	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods.	8-11	8-11	4-7 0-3
8. Bank vegetation stability	Over 80% of the streambank surfaces covered by vegetation, gravel or boulders, and cobble.	50-79% of the streambank surfaces covered by vegetation, gravel or larger material.	25-49% of the streambank surfaces covered by vegetation, gravel, or larger material.	1-5	0-2
9. Streamside cover (b)	Dominant vegetation is shrub.	Dominant vegetation is of tree form.	Dominant vegetation is grass or forbs.	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings.	0-2
Column Totals	Score <u>108</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
			<u>6-8</u>	<u>435</u> <u>73</u> <u>108</u>	<u>0-2</u>

Figure 5.21. (Cont.).

DITE 2

Little Loughery Creek
Columbus Ave - BatesvillePHYSICAL CHARACTERISATION/WATER QUALITY
FIELD DATA SHEET

PHYSICAL CHARACTERISATION	
RIPARIAN ZONE/STREAM FEATURES	
Predominant Surrounding Land Use:	
Present	Field/Pasture
Local Watershed Erosion:	None
Local Watershed Air Pollution:	None
Estimated Stream Width:	4 ft
High Water Mark:	Velocity ≥ 30 cm/sec.
Canopy Cover:	Open
Sediment Odor:	<input checked="" type="checkbox"/> sewage
Sediment Odor:	<input type="checkbox"/> organic
Sediment Deposits:	sludge
Are the undersides of stones which are not deeply shaded black?	
SEDIMENT/SUBSTRATE	
Substrate Size:	Diameter
Boulder	156-mm (6 in.)
Cobble	41-55-mm (1.5-2 in.)
Gravel	21-41-mm (1-1.5 in.)
Sand	0.41-1-mm (.1-.25 in.)
Clay	<0.41-mm (.1 in.)
ORGANIC SUBSTRATE COMPOSITION	
Substrate Size:	Percent composition in sampling area
Boulder	40
Cobble	10
Gravel	30
Sand	10
Clay	10
WATER QUALITY	
Temperature:	c
Instrument(s) Used:	Dissolved oxygen
Stream Type:	Collector
Water Color:	<input checked="" type="checkbox"/> Manganese
Water Surface Oil:	<input checked="" type="checkbox"/> black
Turbidity:	slightly turbid
WEATHER CONDITIONS	
PHOTOGRAPH NUMBER	
OBSERVATIONS AND/OR SKETCH	

(old channel)

Soil Colloids

Obvious Sources

Local Potential Sources

Commercial

Industrial

Other

Soil Colloids

Organic Substrate Components

Percent composition in sampling area

Characteristic

Composition in sampling area

Soil Colloids

Organic

Inorganic

Organic

Site 2
Little Loughery Creek
Batesville

HABITAT ASSESSMENT FIELD DATA SHEET

Habitat Parameter	Category		
	Excellent	Good	Fair
1. Bottom substrate(s) available cover	Greater than 50% rubble, 10-50% gravel, gravel or other stable substrate, or other stable substrate banks, or adequate habitat.	10-50% rubble, gravel or other stable habitat. Habitat availability less than desirable.	Less than 10% rubble, gravel or other stable habitat. Each of habitats is obvious.
	16-20	16-15	6-10
2. Embeddedness (b)	Gravel particles are between 0 and 25% surrounded by fine sediment	Gravel, cobble, and boulder particles are between 25 and 50% surrounded by fine sediment	Gravel, cobble, and boulder particles are over 75% surrounded by fine sediment
	16-20	16-15	6-10
3. >0.15 cms (5 cfs) + arroyo at top. low flow	Cold >0.05 cms (2 cfs) Warm >0.15 cms (5 cfs)	0.01-0.05 cms (1-2 cfs) 0.05-0.15 cms (2-5 cfs)	0.01-0.03 cms (1.5-1 cfs) 0.03-0.05 cms (1-2 cfs)
	10-20	11-15	6-10
or >0.15 cms (5 cfs) + velocity/depth	Slow (<0.1 m/s), deep (0.5 m); slow, shallow (0.3 m); fast (0.3 m/s), deep; fast, shallow habitats all present.	Only 3 of the 4 habitat categories present (missing riffles/runs missing pools).	Only 2 of the 4 habitat categories present (missing riffles/runs receive lower score than missing pools).
	16-20	16-15	6-10
4. Channel alteration(a)	Little or no enlargement of bars, add-on point bar, and/or no channelization.	Some new incision in bar concave, gravel, and/or some channelization present.	Moderate deposition of new material, increased bar concave, gravel, and/or pools partially filled with material; and extensive channelization.
	12-15	12-15	6-10
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition.	5-30% affected. Scour where grades steepen. Some deposition in pools.	More than 50% of the bottom changing deposits and scour at obstructions, constrictions and bends. Some filling of pools due to deposition.
	12-15	6-11	4-7

(a) From Ball 1982.

(b) From Platts et al. 1983.

Note: * = Habitat parameters not currently incorporated into BIOS

Figure 5.2.1. Habitat Assessment Field Data Sheet for use with all Rapid Bioassessment Protocols.

Site 2

Little Laundry Creek
Colombia Ave - Batesville

HABITAT ASSESSMENT FIELD DATA SHEET (cont.)

Habitat Parameter	Category		
	Excellent	Fair	Poor
6. Pool/riffle, run/bend ratio (distance between riffles divided by stream width)	5-7. Variety of habitat in pools and pools. Banks provide habitat.	7-15. Adequate depth in pools and riffles. Banks provide habitat.	>15. Occasional riffle or bend. Bottom contours provide some habitat.
	(9)	8-11	4-7
7. Bank stability (a)	Stable. No evidence of erosion of bank failure.	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 10° on one bank. Slight potential for future problems.	Moderately unstable. Moderate frequency and size of erosion areas. Side slopes >60° common. Side slopes up to 60° on one bank. High erosion potential during extreme high flow.
		9-10	3-5
8. Bank vegetation/stability (b)	Over 40% of the streambank surfaces covered by vegetation or boulders and cobble.	50-79% of the streambank surfaces covered by vegetation, gravel or larger material.	25-49% of the streambank surfaces covered by vegetation, gravel, or larger material.
		(7)	3-5
9. Streamside cover (b)	Dominant vegetation is shrub.	Dominant vegetation is of tree form.	Dominant vegetation is grass or forbs.
		9-10	3-5
Column Totals	Score: 93	④	28 + 63 — 93

Figure 5.2-1. (Cont.).

Site 3

Walnut Cr.
Bridge @ 1300N

PHYSICAL CHARACTERIZATION/WATER QUALITY
FIELD DATA SHEET

PHYSICAL CHARACTERIZATION					
<u>STREAM SITE/STREAM FEATURES</u>					
Predominant Surrounding Land Use:	<input checked="" type="checkbox"/> Agricultural <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy				
Recent Field/Pasture:	<input checked="" type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy				
Local Watershed Erosion:	<input checked="" type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy				
Local Watershed Avg. Pollution:	<input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some Potential Sources <input type="checkbox"/> Obvious Sources				
Estimated Stream Width:	<input checked="" type="checkbox"/> 2 m <input type="checkbox"/> 5 m <input type="checkbox"/> 10 m <input type="checkbox"/> 20 m <input type="checkbox"/> 30 m				
Estimated Stream Depth:	<input checked="" type="checkbox"/> Riffle <input type="checkbox"/> Run <input type="checkbox"/> Pool <input type="checkbox"/> Deep				
High Water Mark:	<input checked="" type="checkbox"/> 230 cm <input type="checkbox"/> 260 cm <input type="checkbox"/> 290 cm <input type="checkbox"/> 320 cm				
Velocity:	<input checked="" type="checkbox"/> 20 cm/s <input type="checkbox"/> 30 cm/s <input type="checkbox"/> 40 cm/s <input type="checkbox"/> 50 cm/s				
Canopy Cover:	<input checked="" type="checkbox"/> Open <input type="checkbox"/> Partly Open <input type="checkbox"/> Shaded				
<u>SEDIMENT/DEBRIS</u>					
Sediment Odor: (None)	<input checked="" type="checkbox"/> Sewage <input type="checkbox"/> Slight <input type="checkbox"/> Moderate				
Sediment Oils: (Absent)	<input checked="" type="checkbox"/> Petroleum <input type="checkbox"/> Trace				
Sediment Depositor: Sludge	<input checked="" type="checkbox"/> Sludge <input type="checkbox"/> Paper Fiber <input type="checkbox"/> Sand				
Are the undersides of stones which are not deeply embedded black?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
<u>INORGANIC SUBSTRATE COMPONENTS</u>					
Substrate Type:	<input checked="" type="checkbox"/> Diameter <input type="checkbox"/> In sapling size				
Bedrock:	<input checked="" type="checkbox"/> 25-50 mm (10-20 in.) <input type="checkbox"/> 50-100 mm (20-30 in.)				
Builder:	<input checked="" type="checkbox"/> 5-10 mm (1-3 in.) <input type="checkbox"/> 10-20 mm (4-8 in.) <input type="checkbox"/> 20-30 mm (8-12 in.) <input type="checkbox"/> 30-40 mm (12-16 in.) <input type="checkbox"/> 40-50 mm (16-20 in.) <input type="checkbox"/> 50-60 mm (20-24 in.)				
Cobbles:	<input checked="" type="checkbox"/> 5-10 mm (1-3 in.) <input type="checkbox"/> 10-20 mm (4-8 in.) <input type="checkbox"/> 20-30 mm (8-12 in.) <input type="checkbox"/> 30-40 mm (12-16 in.) <input type="checkbox"/> 40-50 mm (16-20 in.) <input type="checkbox"/> 50-60 mm (20-24 in.)				
Gravel:	<input checked="" type="checkbox"/> 1-2 mm (1/16-1/8 in.) <input type="checkbox"/> 2-4 mm (1/8-1/4 in.) <input type="checkbox"/> 4-6 mm (1/4-1/2 in.) <input type="checkbox"/> 6-10 mm (1/2-13/16 in.) <input type="checkbox"/> 10-15 mm (13/16-1 1/8 in.) <input type="checkbox"/> 15-20 mm (1 1/8-1 1/4 in.)				
Sand:	<input checked="" type="checkbox"/> 0.25-0.5 mm (1/16-1/8 in.) <input type="checkbox"/> 0.5-1 mm (1/8-1/4 in.) <input type="checkbox"/> 1-2 mm (1/4-1/2 in.) <input type="checkbox"/> 2-4 mm (1/8-1/4 in.) <input type="checkbox"/> 4-6 mm (1/4-1/2 in.) <input type="checkbox"/> 6-10 mm (1/2-13/16 in.) <input type="checkbox"/> 10-15 mm (13/16-1 1/8 in.) <input type="checkbox"/> 15-20 mm (1 1/8-1 1/4 in.)				
Silt:	<input checked="" type="checkbox"/> 0.06-0.25 mm (1/16-1/16 in.) <input type="checkbox"/> 0.25-0.5 mm (1/16-1/8 in.) <input type="checkbox"/> 0.5-1 mm (1/8-1/4 in.) <input type="checkbox"/> 1-2 mm (1/4-1/2 in.) <input type="checkbox"/> 2-4 mm (1/8-1/4 in.) <input type="checkbox"/> 4-6 mm (1/4-1/2 in.) <input type="checkbox"/> 6-10 mm (1/2-13/16 in.) <input type="checkbox"/> 10-15 mm (13/16-1 1/8 in.) <input type="checkbox"/> 15-20 mm (1 1/8-1 1/4 in.)				
Clay:	<input checked="" type="checkbox"/> 0.01-0.06 mm (1/16-1/16 in.) <input type="checkbox"/> 0.06-0.25 mm (1/16-1/16 in.) <input type="checkbox"/> 0.25-0.5 mm (1/16-1/8 in.) <input type="checkbox"/> 0.5-1 mm (1/8-1/4 in.) <input type="checkbox"/> 1-2 mm (1/4-1/2 in.) <input type="checkbox"/> 2-4 mm (1/8-1/4 in.) <input type="checkbox"/> 4-6 mm (1/4-1/2 in.) <input type="checkbox"/> 6-10 mm (1/2-13/16 in.) <input type="checkbox"/> 10-15 mm (13/16-1 1/8 in.) <input type="checkbox"/> 15-20 mm (1 1/8-1 1/4 in.)				
<u>WATER QUALITY</u>					
Temperature: °C	Dissolved Oxygen:	pH:	Conductivity:	Other:	
Instrumental Read:	<input checked="" type="checkbox"/> Watermeter <input type="checkbox"/> Colorimeter				
Stream Type:	<input checked="" type="checkbox"/> Coliform <input type="checkbox"/> Sewage				
Water Odor:	<input checked="" type="checkbox"/> Petrolain <input type="checkbox"/> Sewage				
Water Surface Color:	<input checked="" type="checkbox"/> Slight <input type="checkbox"/> None				
Turbidity:	<input checked="" type="checkbox"/> Slightly Turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Opaque				
WEATHER CONDITIONS					
PHOTOGRAPH NUMBER					
OBSERVATIONS AND/OR SKETCHES					

two shots, 1 upstream (channelized), 1 downstream (unchannelized but sloping banks)

Site 3

Walnut Creek @ 1300 N

HABITAT ASSESSMENT FIELD DATA SHEET

7/8/94

Habitat Parameter	Category		Date
	Good	Poor	
1. Bottom substrates/ available cover	Greater than 50% gravel, submerged logs, or other stable undercut banks, or other stable habitat.	10-50% rubble, gravel or other stable habitat. Adequate habitat.	Less than 10% rubble or other stable habitat. Gravel or other stable habitat availability less than desirable. 6-10
2. Embeddedness (b)	Gravel, cobble, and boulder particles are between 0 and 5% surrounded by fine sediment	Gravel, cobble, and boulder particles are between 50 and 75% surrounded by fine sediment	Gravel, cobble, and boulder particles are over 75% surrounded by fine sediment 6-10
3. 10-15 cms (5 cfs) + flow at rep. low	Cold >0.05 cms (2 cfs) Warm >0.15 cms (5 cfs)	0.01-0.05 cms (1-2 cfs) 0.05-0.15 cms (2-5 cfs)	0.01-0.01 cms (1.5 cfs) 0.01-0.05 cms (1-2 cfs) 0.05-0.15 cms (1-5 cfs) 6-10
or 10-15 cms (5 cfs) + Velocity/depth	SLOW (<0.3 m/s), deep (>0.5 mi); slow, shallow (<0.5 mi); fast, (>0.3 m/s); deep; fast; shallow habitats all present.	only 3 of the 4 habitat categories present missing riffles or runs receive lower score than shallow habitats all missing pools.	Only 2 of the 4 habitat categories present missing riffles/runs receive lower score. 13
4. Channel alteration (a)	Little or no enlargement of islands or point bars, and/or no channelization.	SOME new increase in bar formation, mostly from coarse gravel; and/or some channelization present.	SOME new increase in bar formation, mostly from new gravel, coarse sand material, increased bar on old and new bars; pools partially filled with silt; and/or wails; and/or seabank- ments on both banks 12-15
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition.	5-10% affected. Scour at constrictions and where stakes steepen. Some deposition in pools.	More than 50% of the bottom affected, and obstacles and scour at constrictions, con- structions and pools. Pools almost absent, filled with silt; and/or large rocks in riffle exposed. 6-11
		12-15	6-11

(a) From Bell 1982.

(b) From Platts et al. 1983.

Note: * = Habitat parameters not currently incorporated into BIOS

Figure 5.2.1. Habitat Assessment Field Data Sheet for use with all Rapid Bioassessment Protocols.

HABITAT ASSESSMENT FIELD DATA SHEET (cont.)			
Habitat Parameter	Excellent	Good	Poor
	Category		
6. Pool/run/bend ratio (distance between riffles divided by stream width)	5-7. Variety of habitats. Deep riffles in pools and ripples. Banks provide habitat.	7-15. Adequate depth in pools and riffles. Banks provide habitat.	15-25. Occasional riffle or bend. Bottom contours provide some shelter or shallow habitat.
7. Bank stability (a)	Stable. No evidence of erosion or bank failure. Side slopes generally 30% or less. Little potential for future problems.	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods.	Moderately unstable. Unstable. Many moderate frequency and size of erosional areas. Slopes >60° common. "Ran" areas frequent on same bank. High erosion potential along straight sections and bends.
8. Bank vegetative stability (b)	Over 80% of the streambank surfaces covered by vegetation, gravel or large material.	50-79% of the streambank surfaces covered by vegetation, gravel or large material.	25-49% of the streambank surfaces covered by vegetation, gravel, or larger material.
9. Streamside cover (b)	Dominant vegetation is shrub.	Dominant vegetation is of tree form.	Dominant vegetation is grass or forbs.
Column Totals	Score • <u>72</u>	<u>64</u>	<u>25</u> <u>72</u>

Figure 5.2-1. (Cont.).

Site 4
1050 N. Trk.

PHYSICAL CHARACTERIZATION/WATER QUALITY
FIELD DATA SHEET

PHYSICAL CHARACTERIZATION						
UPSTREAM RIVER/BESTREAM FEATURES						
Proximal Surrounding Land Use:	<i>(Handwritten notes)</i>					
Percent Field/forest:	Residential	Commercial	Industrial	Other		
Local Watershed Erosion:	Heavy					
Local Watershed SP5 Pollution:	No evidence	Some Potential Sources				
Estimated Stream Width:	3	estimated stream depth:	Shallow	sun	pool	0.5 m
High Water Mark:	Velocity 20 cm/sec	Water Present:	no	Channeled:	yes	No ✓
Canyon Cover:	Open	Partly Open	Partly shaded	Shaded		
BEDROCK/SUBSTRATE:						
Sediment Odor:	Normal	Petroleum	Chemical	Anaerobic	Bene	Other
Sediment Oils:	Absent	Slight	Moderate	Profuse		
Sediment Deposits:	Sludge	Sand	Paper fiber	Sand	Bivalve shells	Other
Are the undersides of stones which are not deeply etched black? Yes No						
Intrinsic Substrate Components						
Substrate Type:	Diseased	Percent Compaction	In Sampling Area	Organic substrate components		
Bedrock:	154 mm (10 in)	10		Black	White	Characteristic
Bedrock:	41-53 mm (1.5-2 in)	20		White	Black	In Sampling Area
Gravel:	2-61 mm (0.1-2.5 in)	20		Black	White	
Sand:	0.01-2.00 mm (gritty)	20		Black	Very fine	
Silt:	<0.01-0.06 mm	10		Black	Organic (iron)	
Clay:	<0.01-0.06 mm (felsite)	10		Turbid	Grey, black	
WATER QUALITY						
Temperature:	c	Dissolved Oxygen:	ppm	Conductivity:	µmhos/cm	Other
Instrument(s) Used:	<i>(Handwritten notes)</i>					
Stone Type:	Calcareous	Resinous	Resinous	Resinous	Resinous	Other
Water Odor:	Average	Petroleum	Chemical	Flecks	None	Other
Water Surface Oil:	Black	Sheen	Black	Opaque	Water Color	
Turbidity:	Clear	Slightly Turbid	Turbid			
WEATHER CONDITIONS						
PHOTOGRAPH NUMBER:	1 shot					
OBSERVATIONS AND/OR SKETCH						

Site 4

HABITAT ASSESSMENT FIELD DATA SHEET		1050 N Tributary	
Habitat Parameter	Category	Good	Fair
1. *Bottom substrates/available cover	Good	Greater than 50% rubble, 30-50% gravel, or other stable habitat.	Less than 10% rubble, gravel, or other stable habitat. Gravel or other stable habitat. Habitat availability less than desirable.
		Adequate habitat.	Habitat is obvious.
		11	6-10
2. Embeddedness (b)	Good	Gravel, cobble, and boulder particle size between 0 and 25%, surrounded by fine sediment	Gravel, cobble, and boulder particle size between 50 and 75%, surrounded by fine sediment
		16-20	6-10
		1113	0-5
3. <0.15 cms (5 cfs) * flow at top. low or >0.15 cms (5 cfs) *	Good	Cold >0.05 cms (2 cfs) Warm >0.15 cms (5 cfs) 10-20	0.01-0.03 cms (1-2 cfs) 0.03-0.05 cms (1-5 cfs) 11-15
Velocity/depth		(0.5 mi; slow, shallow (0.5 mi; fast (0.3 mi, deep; fast, shallow habitats all present.	(0.5 mi; fast (0.3 mi, deep; fast, receiving lower score than missing pools). 16-20
		1113	6-10
4. * Channel alteration (a)	Good	Little or no enlargement of islands or point bars and/or no channelization.	Some new increase in bar formation, mostly from coarse gravel; some scouring and/or some channelization.
		16-20	0-5
		1113	0-7
5. Bottom scouring and deposition	Good	Less than 5% of the bottom affected by scouring and deposition.	5-10% affected. Scour at constrictions and where grades steepen. Some deposition in pools.
		12-15	0-1
		1113	4-7
		1113	0-1

(a) From Bell 1982.
(b) From Platts et al. 1983.
Note: * = Habitat parameters not currently incorporated into BIOS

Figure 5.2.1. Habitat Assessment Field Data Sheet for use with all Rapid Bioassessment Protocols.

HABITAT ASSESSMENT FIELD DATA SHEET (cont.)

1050 N. frie

Habitat Parameter	Category		
	Excellent	Good	Fair
6. Pool/riffle, run/bend ratio (distance riffles divided by stream width)	5-7. Variety of habitat and pools. Bends provide habitat.	7-15. Adequate depth in pools and riffles. Bends provide habitat.	15-25. Occasional riffle or bend. Bottom contours provide some habitat.
			Water or shallow riffle. Poor habitat.
		(6)-1	
	12-15		4-7
			0-3
7. Bank stability (a)	Stable. No evidence of erosion on bank. Gentle slopes generally stable. Little potential for future problem.	Moderately stable. Moderate to frequent, mostly shallow, erosion. Gentle slopes up to 45° on one bank. Slight erosion potential in extreme floods.	Unstable. Many side slumps. Gentle slopes up to 45° on one bank. High erosion potential during extreme high flow.
		(6)-1	
	9-10		3-5
			0-2
8. Bank vegetative stability (b)	Over 80% of the streambank surfaces covered by vegetation, gravel or large material.	50-79% of the streambank surfaces covered by vegetation, gravel or large material.	25-49% of the streambank surfaces covered by vegetation, gravel, or large material.
		(6)-1	
	9-10		3-5
			0-2
9. Streamside cover (b)	Dominant vegetation is shrub.	Dominant vegetation is grass or forbs.	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, cut banks, or mine tailings.
		(6)-1	
	9-10		3-5
			0-2
Column Totals	Score: <u>85</u>	—	—

Figure 5.2-1. (Cont.).

Site 5
Lullwater Creek
CR 206 W

PHYSICAL CHARACTERIZATION/WATER QUALITY
FIELD DATA SHEET

PHYSICAL CHARACTERIZATION

UPSTREAM RIVER/STREAM FEATURES

Predominant Surrounding Land Uses:

Forest

Field/Pasture

Agricultural

Residential

Commercial

Industrial

Other

Heavy

Moderate

Low

No evidence

Local Watershed Stream: None

Local Watershed Impacts: None

Potential Sources:

None

obvious sources

Estimated Stream Depth: Little

Run

Pool

Velocity

Fast

Slow

Channelized: Yes

No ↘

Shaded

Partly Shaded

Open

Convey Corri: Open

Partly Open

Partly Closed

SEDIMENT/SUBSTRATE:

Sediment Color: Brown

Source: Petroleum

Chemical

Anomalous

None

Other

Bedrock Color: Absent

slight

Moderate

Profuse

Bedrock Deposits: Sludge

Bedrock

Paper Fibers

Sand

Bullet Shells

other

None Observed

Are the undersides of stones which are most deeply embedded black?

Yes

No ↗

Shaded

Partly Shaded

Open

Convey Corri: Open

Partly Open

Partly Closed

Open

Convey Corri: Open

</div

Site 5

HABITAT ASSESSMENT FIELD DATA SHEET

Habitat Parameter	Excellent		Good		Fair		Poor	
	Cat 1	Cat 2	Cat 1	Cat 2	Cat 1	Cat 2	Cat 1	Cat 2
1. Motion substrate(s) available cover	Greater than 50% rubble, 10-50% gravel, other stable habitat, adequate banks or other stable habitat.	Other stable habitat, adequate banks or other stable habitat.	Less than 10% rubble, gravel or other stable habitat, lack of availability less than desirable.	Less than 10% rubble, gravel or other stable habitat, lack of habitat, lack of habitat is obvious.				
	(1) 20		11-15	6-10				
2. Embeddability (b)	Gravel, cobble, and boulders particles are between 0 and 35 % surrounded by fine sediment	Gravel, cobble, and boulders particles are between 50 and 75 % surrounded by fine sediment	Gravel, cobble, and boulders particles are between 50 and 75 % surrounded by fine sediment	Gravel, cobble, and boulders particles are over 75 % surrounded by fine sediment				
	(16) 20		11-15	6-10				
3. 50.15 cms (5 cfts) + flow at rap. low	Cold >0.05 cms (2 cfts) Warm >0.15 cms (5 cfts)	0.03-0.05 cms (1-2 cfts) 0.05-0.15 cms (2-5 cfts)	0.01-0.03 cms (1.5-1 cfts) 0.03-0.05 cms (1-2 cfts)	0.01-0.03 cms (1.5-1 cfts) 0.03-0.05 cms (1-2 cfts)				
or								
50.15 cms (5 cfts) + Velocity/depth	Slow (<0.3 m/s); deep (>0.5 m); slow, shallow (<0.5 m); fast (>0.3 m/s); deep; fast, shallow habitats present.	Only 3 of the 4 habitat categories present (missing riffles or runs receive lower score than missing pools).	Only 2 of the 4 habitat categories present (missing riffles/runs receive lower score).	Only 2 of the 4 habitat categories present (missing riffles/runs receive lower score).				
	(1) 20		11-15	6-10				
4. Channel alteration (a)	Little or no enlargement of islands or point bars; and/or no channelization.	Some new increase in bar formation, mostly from coarse gravel; and/or some channelization present.	Moderate Aggradation of material in bars and on old and new bars; visible and/or extensive channelization.	Heavy Aggradation of material in bars and on old and new bars; visible and/or extensive channelization.				
	(1) 15		8-11	4-7				
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition.	5-10% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	10-50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools.	More than 50% of the bottom changing nearly year long. Pools almost absent. Only large rocks in riffle exposed.				
			12-15	4-7				

(a) From Ball 1982.
 (b) From Platts et al. 1983.

Note: * = Habitat parameters not currently incorporated into BLOS

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Figure 5.2-1. Habitat Assessment Field Data Sheet for use with all Rapid Bioassessment Protocols.

HABITAT ASSESSMENT FIELD DATA SHEET (cont.)

Site 5

Habitat Parameter	Category		
	Excellent	Good	Fair
6. Pool/riffle, run/bend ratio (distance between riffles divided by stream width)	5-7. Variety of habitat. Deep riffles and pools. Bends provide habitat.	7-15. Adequate depth in pools and riffles. Bends provide habitat. (P)	15-25. Occasional riffle or bend. Bottom straight stream contours provide some habitat. (P)
		8-11	4-7 0-1
7. Bank stability (a)	Stable. No evidence of erosion or bank failure. Side slopes generally 10% or less. Little potential for future problems.	Moderately stable. Erosion evident near head of reach. Side slopes up to 10% on one bank. Slight potential in extreme floods. (7)	Moderately unstable. Moderate frequency and extent of erosion. Side slopes 30% or more. Slope 30% or greater. Side slope prone to collapse on same bank. High erosion potential during extreme high flow. (6)
		9-10	3-5 0-2
8. Bank vegetation stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble.	50-79% of the streambank surfaces covered by vegetation, gravel, or larger material. (6)	Less than 15% of the streambank surfaces covered by vegetation, gravel, or larger material. (5)
		9-10	3-5 0-2
9. Streamside cover (b)	Dominant vegetation is shrub.	Dominant vegetation is of tree form. (6)	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. (5)
		9-10	3-5 0-2
Column Totals	Score <u>102</u>	<u>31</u>	—

5-6

Figure 5.2-1. (Cont.).

MACROINVERTEBRATE DATA SHEET

Type of Sampler _____
 Collection Depth _____
 Substrate Type riffle
 Remarks _____

Sample No. # 1
 Date Oct 94
 Location Salt Creek at CR 50 N
 (Decatur Co.)

Identification by G. Bright
 Enter Family and/or Genus and Species Name on Blank Line.

Station # Site 1
 Collector G. Bright

Organisms	No.	A.	I.
Diptera			
Chironomidae			
Thienemannimia sp.	14		
Cricotopus bicinctus	6		
Orthocladius obumbratus	2		
Other			
Tipula sp.	1		
richoptera			
Cheumatopsyche sp.	41		
Ceratopsyche bifida	4		
Hydropsyche betteni	9		
Chimarra obscura	1		
lecoptera			
Capniidae	1		
phemeroptera			
Baetis sp.	1		
Isosynchia sayi	1		
Stenonema vicarium	1		
donata			
emiptera			

= Adult. I = Immature

Total No. Organisms 100

Organisms	No.	A.	I.
Coleoptera			
Psephenus herricki	1		
Stenelmis sexlineata	2		
Neuroptera and Megaloptera			
Crustacea			
Oligochaeta			
Hirudinea	10		
Bivalvia			
Gastropoda			
Fernssia rivularis	2		
Bryozoa			
Coelenterata			
Other			

Total No. Taxa 16 genera

MACROINVERTEBRATE DATA SHEET

Type of Sampler _____ Sample No. #2
 Collection Depth _____ Date Oct 94
 Substrate Type riffle Location Salt Creek at CR 50 N
 Remarks Sample sorted by M. Broaddus (Decatur Co.)
 Identification by G. Bright
 Enter Family and/or Genus and Species Name on Blank Line.

Organisms	No.	A.	I.
Diptera			
Chironomidae			
Parametriochenus lundbecki	1		
Thienemanniymia sp.	9		
Other Tipula sp.	2		
Trichoptera			
Cheumatopsyche spp.	65		
Hydropsyche bettegi	4		
Ceratopsyche bifida	1		
Plecoptera			
Capniidae	1		
Ephemeroptera			
Baetis flavistrigia	1		
B. brunneicolor	1		
Odonata			
Hemiptera			

A = Adult. I = Immature.

Total No. Organisms 100

	No.	A.	I.
Coleoptera			
Stenelmis sp.	2		
Psephenus herricki	3		
Neuroptera and Megaloptera			
Crustacea			
Oligochaeta			
Hirudinea	4		
Bivalvia			
Gastropoda			
Physella sp.	1		
Bryozoa			
Coelenterata			
Other Turbellaria	5		

Total No. Taxa 13 genera

Metric Values

	Sample 1	Sample 2
Total Genera	16	13
EFT Genera	8	5
Scrapers/Filterers	0.05	0.06
% Dominant Taxon	41	65
EPT/Chironomids	2.7	7.3
Community Loss Index	0.19	0.39
Hilsenhoff Biotic Index	6.5	6.3
% Shredders in CPOM	1.5	1.0

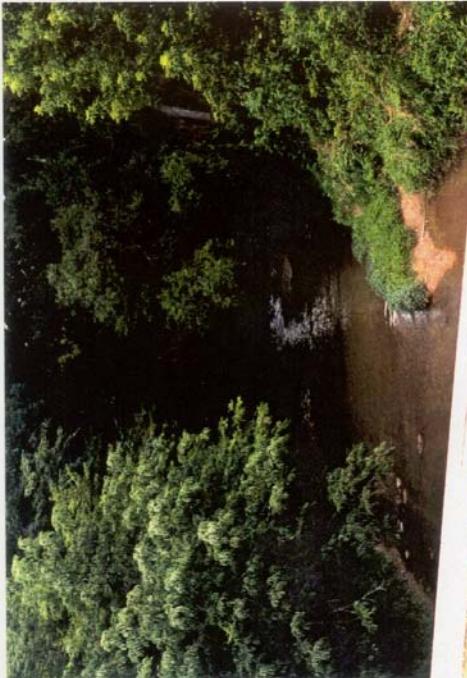
Site Scores in Relation to the Reference

	Sample 2 Sample 1 as Reference	Sample 1 Sample 2 as Reference
Total Genera	6	6
EFT Genera	4	6
Scrapers/Filterers	6	6
% Dominant Taxon	0	0
EPT/Chironomids	6	2
Community Loss Index	6	6
Hilsenhoff Biotic Index	6	6
% Shredders in CPOM	6	6
----	----	----
	40	38

Mean Site Score = 39

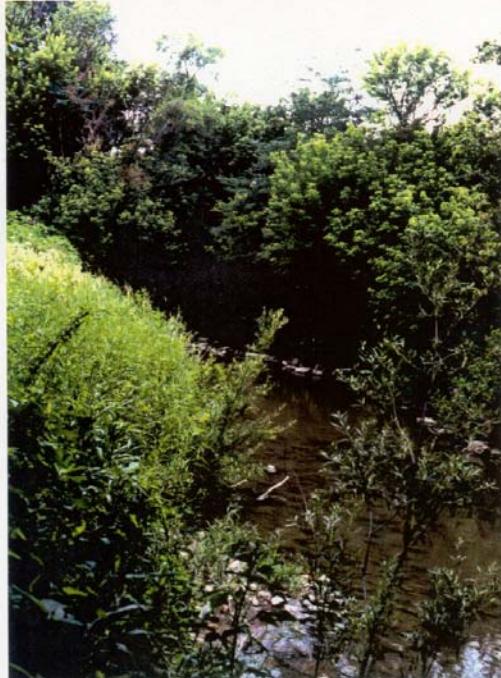
Each duplicate is within 10% of the mean

Each score indicates "nonimpaired" in comparison to the reference



Salt Creek - Site 1
Reference

Walnut Creek
Site 3



Little Laughery Creek
Site 2

Unnamed Tributary
Site 4



